

REMARKS/ARGUMENTS

Status of Application

Claims 1-27 are pending in this application. Claims 1-20 stand rejected. Claims 1, 5-10, 15-17, and 19 have been amended and claims 21-27 have been added. This Amendment does not add new matter.

Claims 1-7, 13 and 19-20 have been rejected under 35 U.S.C. § 103 for obviousness over U.S. Patent No. 6,686,639 Tsai ("Tsai") in view of U.S. Patent No. 6,758,983 Conant et al. ("Conant"). Claims 8-12 and 14-18 have been rejected under 35 U.S.C. § 102 for anticipation by Tsai.

The Claimed Invention

The following characterization of the invention is provided for convenience; the claim language governs.

The invention relates to improvements in micro-electro-mechanical system (MEMS) scanning mirror devices of the type that include a scanning mirror, a beam structure having one end connected to the scanning mirror, and a spring attached to the beam structure. Applicant believes that there are at least two patentable aspects of the invention:

- the beam structure having one end connected to a plurality of locations on the scanning mirror; and
- a plurality of springs attached to the beam structure.

Independent claims 1, 8, 15, 26 and 27 recite, in one way or another, a MEMS scanning mirror device incorporating at least one of these aspects. Some claims incorporate both aspects, but it is believed that each is patentable in its own right.

As pointed out in paragraph 10, the connection of the beam structure to a plurality of locations on the scanning mirror improves optical resolution of the device by minimizing dynamic deformation of the scanning mirror. Further, as pointed out in paragraph 15, the plurality of springs attached to the beam structure (i.e., the distributed spring design) improves device reliability by reducing maximum stress and strain on each individual spring.

The Prior Art

Claims 1-7, 13 and 19-20 have been rejected under 35 U.S.C. § 103 for obviousness over Tsai in view of Conant. Claims 8-12 and 14-18 have been rejected under 35 U.S.C. § 102 for anticipation by Tsai. Applicants respectfully submit that the prior art, regardless of how combined, does not suggest the present invention.

Tsai

The Examiner states that “Tsai teaches a MEMS device comprises a scanning mirror (141), a beam structure located between the torsion spring (143) and the mirror wherein the beam structure is connected with the scanning mirror, a plurality of torsion springs (143) connected to the to a stationary bond pad (144 and 145) wherein the stationary pad serves as an anchor and a stationary surface wherein the springs connected to the beam structure along rotational axis of the scanning mirror, a stationary comb teeth or structures (131 and 132) in which the stationary comb structure and the rotational comb teeth are interdigitated.”

Tsai shows several embodiments, some of which appear to have torsion springs directly attached to the mirror. However, FIGS. 1 and 2 can be considered, for the sake of argument, to show beam structures (not explicitly denoted) to which the comb teeth 142 are attached, and torsion springs 143 outboard of the beam structures.

However, Tsai fails to particularly teach or fairly suggest that the beam structure is connected to a plurality of locations on the scanning mirror. Nor does Tsai teach or suggest having more than one spring attached to each beam structure extension.

Conant

As best can be determined, Conant teaches a MEMS scanning mirror device having a combteeth spine 34 connected to a mirror 40, and the mirror is said to have associated torsional hinges 42. The torsional hinges, which are anchored, provide restoring torque when applied voltage between the moving and fixed combteeth structure is removed. The Examiner appears to be taking the position that torsion springs 42 are part of the beam structure, and therefore each side of mirror 40 has two parts of the beam structure, namely the torsion spring and the spine, attached to it. Applicant respectfully submits that Conant's torsion springs 42 are

not part of the beam structure. Thus Conant cannot be said to mention attaching the beam structure to a plurality of locations on the scanning mirror.

The Claims Distinguish Over the Cited Art

§ 102 rejection of claims 8-12 and 14-18

Claims 8-12 and 14-18 have been rejected under 35 U.S.C. § 102 for anticipation by Tsai.

Since Tsai has beam structures extending out from opposite sides of the mirror, one may argue that there are two (i.e., a plurality of) springs attached to the beam structure, even though there is only one spring attached to each of the two beam extensions. Applicant respectfully submits that the prior art does not suggest having more than one spring attached to each of these beam extensions or that doing so would have any advantage.

While FIG. 5 of Tsai does show a scanning mirror device with four silicon springs connected to the four corners of a moveable rectangular mirror and to stationary bond pads, there is no beam structure to which these springs are attached. However, even if a portion of each spring could be considered as an extending beam structure, there is only one spring attached to each of the four extending beam structures. Tsai also states that the FIG. 5 device is used for translational motion of the micromirror.

Claims 8 and 15 have been amended to recite that of the plurality of springs, one of the springs is between the mirror and another spring. This clearly negates the ability to read Tsai's arrangement where a single spring is connected to each beam structure. Claim 15 has also been amended to recite that the springs provide restoring torque at spaced positions along a rotational axis of the scanning mirror.

§ 103 rejection of claims 1-7 and 13

Claims 1-7 and 13 have been rejected under 35 U.S.C. § 103 for obviousness over Tsai in view of Conant. As previously noted, Tsai teaches a MEMS scanning mirror device having a beam structure connected to the mirror, but fails to particularly teach or fairly suggest that the beam structure is connected to a plurality of locations on the scanning mirror. The Examiner uses Conant to show that it "would have been obvious to one of ordinary skill in the

art at the time the invention was made to adapt the teachings of Conant to the teachings of Tsai in order to provide an improved MEMS device by separating the holding device or spine of the combteeth with the torsional hinges wherein the torsional hinges are dedicated to restore the mirror position when the voltage is removed and the combteeth spine is dedicated to the control the movement of combteeth.”

Applicant respectfully submits that the prior art, regardless of how combined, does not suggest attaching the beam structure to a plurality of locations on the scanning mirror for the purpose of improving optical resolution of the device by minimizing dynamic deformation of the scanning mirror. Tsai only shows the beam structure attached to the scanning mirror at one location. In Conant, there are two separate parts (i.e., a torsional hinge and a spline) attached to each side of the scanning mirror, but the two separate parts are not connected together as one beam structure.

Since Tsai has beam structure extending out from opposite sides of the mirror, one may argue that there are two (i.e., a plurality of) attachments to the mirror, even though there is only one attachment to the mirror for each of these two extensions. Claim 1 has been amended to recite that the beam structure extends from one end at the scanning mirror to another end spaced from the scanning mirror, and that the multi-location connection is at the one end. This excludes configurations where there the multiple beam attachment locations are on separate beam structures, such as in Tsai and Conant.

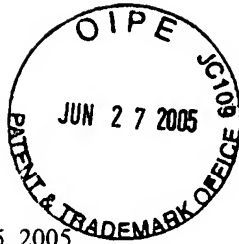
§ 103 rejection of claims 19 and 20

Since claims 19 and 20 are rejected for the same reasons as claims 1-7 and 13, the same arguments as above may be applied to claims 19 and 20.

The New Claims

Applicant has added new claims 21-27, of which claims 26 and 27 are independent. These claims recite two beam structures, and therefore further distinguish over the prior art as discussed above. No new matter is added. Applicant has introduced the reference to proximal and distal ends into claims 26 and 27. This is common nomenclature, and consistent with the specification's reference to the “proximate” (amended to recite “proximal”) end.

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PATENT

CONCLUSION

In view of the foregoing, Applicant believes all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

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